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ALABAMA

Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

AUBURN

Annual Report of the Director of the Experiment Station on Work Done Under the Local Experiment Law in 1920

By
J. F. DUGGAR,
Director

1921
Post Publishing Company,
Opelika, Ala.

Auburn, Ala., Feb. 10, 1921.

HON. M. C. ALLGOOD,
Commissioner of Agriculture and Industries,
Montgomery, Alabama.

Dear Sir:

In accordance with Section 5 of the Local Experiment Law, requiring me, as Director of the Experiment Station of the Alabama Polytechnic Institute, to make a full and complete annual report through the Commissioner of Agriculture to the Governor of Alabama, I herewith hand you my report of work done under the Local Experiment Law in the calendar year 1920, with the request that you transmit this report to Governor Thomas E. Kilby.

Yours very truly,
J. F. DUGGAR,
Director, Experiment Station of
the Alabama Polytechnic Institute.

AGRICULTURAL EXPERIMENT STATION

OF THE

ALABAMA POLYTECHNIC INSTITUTE

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STAFF OF SPECIALISTS ENGAGED IN WORK UNDER THE LOCAL EXPERIMENT LAW

J. F. DUGGAR, *Director*

AGRICULTURE AND PLANT BREEDING

* J. F. DUGGAR, in charge

* E. F. Cauthen ---------- Agriculturist
* M. J. Funchess ---------- Soils
J. T. Williamson ----------
----------Supt. Co-operative Experiments in Agriculture
* H. B. Tisdale ----------Associate Plant Breeder

LIVESTOCK AND POULTRY INVESTIGATIONS

J. C. Grimes, in charge

G. L. Burleson ---------- Assistant in Animal Husbandry

ENTOMOLOGY

* W. E. Hinds, in charge

* F. L. Thomas ----------Associate Entomologist
* J. M. Robinson ---------- Assistant Entomologist

HORTICULTURAL INVESTIGATIONS

* G. C. Starcher, in charge

* Lyle Brown ---------- Assistant Horticulturist

PLANT DISEASES

* ----------, in charge

DRAINAGE AND FARM MACHINERY

M. L. Nichols ---------- Agricultural Engineer
**G. A. Hart ---------- Drainage Engineer

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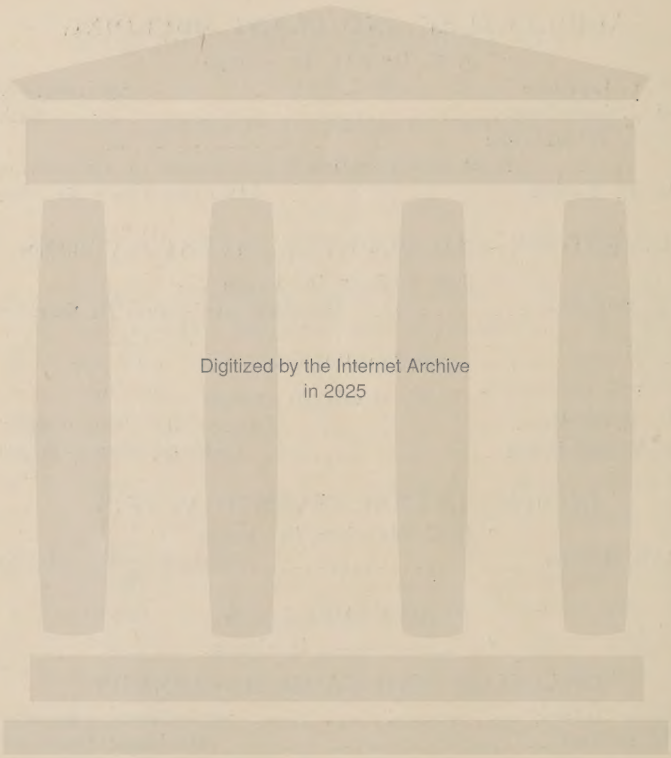
* Devoting only part time to Local Experiment Work.

**In co-operation with United States Department of Agriculture.



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REPORT OF WORK DONE DURING 1920 UNDER THE LOCAL EXPERIMENT LAW

PART I

DIRECTOR'S SUMMARIZED REPORT OF WORK IN ALL DEPARTMENTS

By
J. F. Duggar, Director of Experiment Station.

By reason of a law passed by the Legislature of Alabama in 1911, and generally known as the Local Experiment Law, it has been possible for the Experiment Station to conduct tests on farms throughout the state. The work done under this state law is of a strictly practical character, the results of which may be promptly utilized by anyone on reading the results or inspecting the experiment fields which may be found scattered throughout the state.

Publications

The publications issued during the calendar year 1920 under this fund were the following:

Bulletin No. 209: "Time of Applying Nitrate of Soda to Cotton."
Bulletin No. 210: "Time of Applying Nitrate of Soda to Corn."
Bulletin No. 212: "Poisoning the Boll Weevil."
Bulletin No. 214: "Summary of Investigations on Effect of Tile Drains in the Lime or Prairie Section of Alabama."
Circular No. 43: "Annual Report of the Director of the Experiment Station on Work Done Under the Local Experiment Law in 1920."

Field Crops and Fertilizers

As in other recent years the main subjects of study were the fertilizers most profitable for cotton and corn on the principal soil types of Alabama; the best sources of nitrogen and phosphoric acid for such fertilizers; the best varieties of cotton, corn, oats, peanuts, cowpeas, soybeans and other forage crops for the different parts of Alabama. Especial attention was paid to the species and varieties of grasses and clovers,

and of grass and clover mixtures, suited to the principal soils of the state.

The work of Mr. J. T. Williamson, Superintendent of Cooperative Experiments in Agriculture, was supplemented by work done by the soil specialist of the Experiment Station, Professor M. J. Funchess. The latter collected and began the examination of soil samples from all parts of the state for a determination of the amounts of lime required to overcome the acidity in each; he helped to make photographic records of the growth of forage crops in numerous local experiments; he classified the soils of many experiment fields; and he also supervised a plant-to-row corn breeding experiment.

Plant Breeding

The Associate Plant Breeder, besides conducting at Auburn, under other funds, investigations looking to the improvement of corn and peanuts, has supervised a considerable amount of plant breeding of a more popular nature in other parts of the state. His main work away from Auburn has been the testing of varieties of wilt-resistant cotton, and the carrying on, in a number of localities, of breedng experiments intending to separate for multiplication superior strains from wilt-resistant varieties, and to develop wilt resistance in certain popular varieties now susceptible to wilt or blackroot. In estimating the importance of the breeding up of varieties resistant to wilt or blackroot we should bear in mind that not only is this disease generally prevalent throughout the southern half of the state but that it is continuously working its way northward.

Insect Pests

A new insect pest, the Mexican Bean Beetle, has recently invaded Alabama. Its coming threatens the growing of snap beans, cowpeas and of certain other legumes just as ominously as the advent of the boll weevil some years before threatened cotton production,—a threat that we all know to have been realized in the annual tax of many millions of dollars that the boll weevil has laid on the cotton growers of Alabama.

Experimental work of surpassing importance has been begun in 1920 by the Experiment Station under this law in laying the foundations for a fight against the Mexican Bean Beetle. Soon after its presence in

Alabama became known the representatives of the Experiment Station, with some help from other agencies, explored and mapped the area covered. The Mexican Bean Beetle was found to occur in scattered localities in thirteen counties in the northern part of Alabama, being most abundant in Jefferson County and around Blocton in Bibb County. In these localities it completely destroyed fields of snap beans and cowpeas.

Experiments were immediately started with a view to devising means of combatting this new insect, which was soon found to be unusually resistant, not only to poisoning, but even to fumigation. The information thus secured, though covering only a part of one season, has been most useful in serving as a basis for warning the public of the danger and regarding means of minimizing loss; in devising measures for retarding the inevitable spread of the pest into all Alabama counties and into other states.

A start having thus been made the Experiment Station is now in position to plan more intelligently for a continuation in 1921 and in later years of its search for methods of combatting this most serious pest.

So serious is the menace to the growing of garden beans and of soil-improving crops, throughout the state, that the department of entomology has been furnished in 1920 with more than twice its share (ordinarily $2300) of the funds directly appropriated for work away from Auburn with insects. This has been possible under that provision of the law allowing some discretion in administration as between the several original items of allotment.

Extensive experiments in poisoning the cotton boll weevil with calcium arsenate were continued in 1920, the experiment fields of the year being located in Geneva, Russell ,and Macon Counties, each supervised by an employee kept for a number of months in the locality to make the necessary applications, counts and records. The results of these and of earlier local experiments with the use of calcium arsenate are published in Bulletin No. 212 of this Station.

There is urgent need for a continuation on a large scale of these experiments in poisoning the cotton boll weevil, so as to secure data under a variety of conditions of weather and of latitude with a view to determining when poisoning promises to be profitable and

when unprofitable. However, the present limited financial support of the Experiment Station makes impossible a vigorous prosecution on an adequate scale in the same year of both bean beetle investigations and dusting experiments against boll weevil.

The entomologists have rendered assistance in the fight against the grass worm that again in 1920 attacked corn and many other grass-like plants in Alabama. They have also recorded and prepared for publication a list of insect pests found to occur in that year in many parts of the state.

Animal Husbandry

Experiments with beef cattle under the Local Experiment Law were conducted at Allenville in the winter of 1919-20. Four lots of steers were fed to secure additional data as to the relative advantages of feeding velvet beans in the ground, soaked, or dry and unground condition.

Two lots of cows were fed experimentally to ascertain whether sorghum silage or Johnson grass hay is the most expedient roughage for use in connection with small amounts of cottonseed meal for wintering beef cattle.

With hogs an experiment has been begun on the farm of Mr. Parke Thompson, Goshen, Pike County, to determine, under south Alabama conditions, the relative values of corn or tankage, or a mixture of corn and tankage, as a supplement to peanuts.

Investigations with poultry: The experimental work in this subject has been continued on the same poultry farm as heretofore, near Citronelle, in Mobile County.

One of the main objects last year was to test the relative values of peanut meal, velvet bean meal, and other protein feeds, and to secure data bearing on the most advantageous marketing and on the best basis of selecting poultry.

Horticulture

Studies and observations on the behavior and relative value of varieties of various fruits have been continued. Additional plantings of varieties of apples have been made, including 10 varieties with an area of 18 acres in Talladega County. In the same orchard it is planned to make a study of the fertilizer require-

ments and of the best cultural methods for the production of apples.

Tests of the effects of various amounts of nitrate of soda on Satsuma orange trees have resulted in demonstrating the great increase in the yields afforded by a judicious application of nitrogen, and of its effect in restoring to a productive condition an orange orchard seriously damaged by a freeze several years ago.

Drainage

Assistance in farm drainage, including the making of surveys and maps for the laying of tile drainage, was rendered on 25 properties widely scattered throughout Alabama, where the owners were ready to go to the expense of installing systems of drainage.

A bulletin was prepared by the U. S. Drainage Engineer, cooperating with the Alabama Experiment Station, which bulletin summarizes the results of several years of experimental work in draining prairie land with tile. The principal conclusions were that in this class of soil the depth should usually be 3 to 3½ feet that a distance of 60 to 75 feet between the rows of tile was most satisfactory; and that in the drainage of prairie land it is more important to locate and tile the seepy spots than to incur the expense of draining large fields that are in fairly good productive condition.

In other lines of agricultural engineering the chief features of the local work have been with the following subjects:

Methods and cost of most effectively clearing cut over lands in South Alabama.

Means of extracting from the stumps and refuse wood a larger amount of valuable products as a means of reducing the net cost of land clearing.

In addition, some preliminary work has been done on wood preservation with a view to the renovation of shingle roofs and other parts of old farm structures; in adapting a machine to the distribution of fertilizers for citrus trees; and in collecting data relative to the relation between soil types and proper grades of terraces.

Plant Diseases

In addition to the work conducted by the plant breeder with a view to the development of strains and varie-

ties resistant to cotton wilt or blackroot, the plant pathologist has made preliminary observations on various diseases of plants in many parts of the state. These have included notes on diseases of various species of vetch, bur clover and related species, sweet clover, Johnson grass, sudan grass, and other forage crops. These have been taken with a view to making more extensively available the results that promise to come from investigational work at Auburn under other funds regarding these plant diseases. In this latter work, incomplete experiments indicate that various methods of seed treatment constitute promising means of combatting several of these diseases.

The Experiment Station was unfortunate in losing the services of the head of this department, Dr. G. L. Peltier, who resigned April 1, 1920, to accept a more lucrative position in another institution. His assistant, Mr. A. F. Thiel, continued in charge and made notable progress in the study of diseases of forage plants, but for a similar reason resigned November 15, 1920. Since that date the limited financial resources of the Experiment Station have made it advisable to leave the position vacant for at least a few months, so as to permit the funds thus saved to accumulate for the better equipment of the department when the position is filled.

TREASURER'S REPORT, LOCAL EXPERIMENT FUND FOR THE YEAR 1920

Receipts

To cash balance from 1919	$ 4,303.53
To cash from State 1920	27,000.00
Total	$31,303.53

Disbursements

By amount paid Agriculture	$10,210.71
By amount paid Animal Husbandry	3,598.73
By amount paid Drainage and Farm Machinery	990.24
By amount paid Entomology	4,744.52
By amount paid Horticulture	1,702.49
By amount paid Plant Breeding	1,272.90
By amount paid Plant Pathology	967.32
By amount paid Poultry Husbandry	577.97
By amount paid Printing and Administration	3,936.39
By balance carried to 1921	3,302.26
Total	$31,303.53

Respectfully,
M. A. Glenn,
Treasurer Alabama Polytechnic Institute.

Subscribed and sworn to before me, this the 24th day of January, 1921.

B. L. Shi, Notary Public.

This is to certify that I have compared the account with the ledger account of the Treasurer and this is a correct transcript of the same.

Spright Dowell,
President, Alabama Polytechnic Institute.

PART II

DETAILED REPORTS OF HEADS OF DEPARTMENTS

REPORT OF SUPERINTENDENT OF COOPERATIVE EXPERIMENTS IN AGRICULTURE

Prof. J. F. Duggar,

Auburn, Alabama.

Dear Sir:

Herewith I submit a brief report of the work done by the Local Experiment Division of the Agricultural Department for 1920.

Number and Location of Experiments: The exact number of experiments conducted and their locations cannot be given because the records containing this information were destroyed in the Agricultural Building by fire on the night of October 16, 1920. However, it can be safely said that more than 200 experiments were conducted along at least 33 different lines. These experiments were located on the most important soil types and in fifty or more counties.

Lines of Experimentation: The following constitute the principal lines of experiments which were conducted in the year 1920.

Corn, complete fertilizer experiments.
Corn, complete lime experiments.
Corn, time of applying nitrate of soda.
Corn, best sources of nitrogen.
Corn, best sources of phosphate.
Corn, extensive variety tests.
Corn, ear-to-row breeding experiments.
Corn, multiplication of bred-up strains.
Cotton, complete fertilizer experiments.
Cotton, complete lime experiments.
Cotton, time of applying nitrate of soda.
Cotton, best sources of nitrogen.
Cotton, best sources of phosphate.
Cotton, extensive variety tests.
Cotton, multiplication of bred-up strains.
Cowpeas, extensive variety tests.
Fertilizer-Rotation experiments.
Forage crop experiments, extensive.
Bur clover and alfalfa, short variety tests.
Kudzu, multiplication.
Oats, short variety tests.

Oats, multiplication of bred-up strains.
Peanuts, complete fertilizer experiments.
Peanuts, extensive variety tests.
Rice, short variety tests.
Rye, short variety tests.
Soybeans, extensive variety experiments.
Sugar cane, complete fertilizer experiments.
Sweet potatoes, complete fertilizer experiments.
Vetch, short variety tests.
Velvet beans, short variety tests.
Wheat, short variety experiments.
Wheat, multiplication.

New lines of Experimentation: Other experiments, in addition to the Fertilizer-Rotation tests, comparing acid phosphate, basic slag, and rock phosphate as sources of phosphorus for corn and for cotton, were added in the spring of 1920. Eight experiments in as many different counties were conducted with each of these crops.

Previous to 1920 all Sources of Nitrogen Experiments and all Special Nitrate Experiments were fertilized with nitrogen and phosphorus only, but in order to secure further information on the potash requirements of the various soils as relating to corn and to cotton there have been added plots on which a complete fertilizer is used.

Short Variety Experiments with Soybeans, carrying three varieties of soybeans in comparison with one variety of cowpeas, were changed to Extensive Variety Experiments in which nine of the most promising varieties of soybeans were used.

Forage Crop Experiments: Extensive Forage Crop Experiments, each carrying twenty plots on which were planted almost all of the promising true clovers, vetches, and bur clovers, as well as melilotus, alfalfa, and lespedeza, were located as follows:

Butler County on Myatt fine sandy loam.
Colbert County on Decatur silt loam.
Cullman County on DeKalb loam.
Etowah County on Connasauga clay or Colbert clay.
Elmore County on Kalmia sandy loam.
Escambia County on Greenville sandy loam.
Houston County on Norfolk sandy loam.
Jefferson County on Decatur clay or Decatur silt loam.
Limestone County on Decatur clay loam.
Limestone County on Clarkesville silt loam.
Perry County on Houston clay.
Tuscaloosa County on Cahaba loam.

One-half of each plot of the Extensive Forage Crop

Experiments was limed at the rate of two tons of ground limestone per acre. Acid phosphate was used on the central portion of each plot at the rate of 100 pounds per acre. All legumes were inoculated with pure cultures obtained directly from a reputable laboratory. Detailed notes were carefully made on all these experiments. Photographs were taken where the comparative differences of the several forage crops, or the fertilizer effects on them, were especially striking. However, all these records were destroyed by fire.

This line of experimentation is being continued in 1921 in nearly the same locations as in 1920. Potash in the form of kainit at the rate of 400 pounds per acre is being used in addition to the acid phosphate and the ground limestone.

Publications: Bulletins No. 209 "Time of Applying Nitrate of Soda to Cotton"—and No. 210—"Time of Applying Nitrate of Soda to Corn" were published jointly by Professor E. F. Cauthen, of the Experiment Station, and the writer.

A manuscript giving the results of "Local Fertilizer Experiments with Cotton in North Alabama, 1914-19," was practically ready for publication when it was destroyed by fire. This bulletin was to have been the most complete we have ever issued on fertilizers for cotton. The manuscript contained a record of the yield, increase, and profit, from each fertilizer in each of more than 100 experiments; the soil type and, in most cases, the date of planting, of fertilizing, and of the first picking. Monthly rainfall records for that part of the State and other climatological data were included.

Multiplication of Improved Seed: Although the fire of October 16 destroyed all records of the improved seed that had been distributed to farmers making experiments for the Station, a few records have been saved. One of these shows that about 300 acres of cotton planted in 1920 came originally from 22 pounds of Cook No. 1010, a very productive strain that had been bred up by the Alabama Experiment Station and seed of which had been sent to an experimenter in the spring of 1918. This man made, in 1920, more than 100 bales of cotton from multiplication of the 22 pounds of seed which was received three years previous.

Another experimenter sold in 1920 about 200 bushels of seed of Cook No. 1938, also bred up at Auburn—all

descended from a single bushel of seed obtained from this station in 1918.

Seed corn which this Division has sent out is being grown and kept pure by experimenters.

One experimenter had approximately twenty acres in an Auburn-bred strain of Alabama Blue Stem wheat from seed which he originally obtained from this Station.

Respectfully submitted,
J. T. Williamson,
Superintendent Cooperative Experiments.

REPORT OF ASSOCIATE PLANT BREEDER

Prof. J. F. Duggar,
Auburn, Alabama.

Dear Sir:

I submit the following report of work done in Plant Breeding under the Local Experiment fund during the year 1920.

The cooperative breeding of wilt resistant varieties of cotton was continued. Plant-to-row tests and increase plots of the best strains of each variety were conducted in three counties as follows: Cook No. 307-6 wilt resistant strains in Macon County; Cook No. 307-6 wilt resistant strains in Barbour County; and Toole wilt resistant strains in Henry County. These experiments were closely observed during the year and the best strains were ginned separately for rapid multiplication. About fifty individual plant selections were made from each row test and increase plot. The seed distributed from the breeding plots have been followed by record and observation and growers have been urged to gin such cotton separately and to keep the seed pure for planting.

The local breeding work has brought about very encouraging results as shown by the fact that last season the demand for high grade planting seed descended from strains bred up by this Station was greater than the supply. The cooperative planting and ginning of a single variety of cotton for the entire community has been encouraged and is now being practiced by several communities of the State.

A considerable number of crosses between the best wilt resistant strains and several varieties of high yielding non-resistant varieties and long staple varieties were made for the purpose of increasing the yield and quality of staple of the wilt resistant strains and of adding wilt resistance to the best varieties that are now susceptible to this prevalent disease.

Seventeen wilt resistant varieties of cotton were tested on wilt infected soil in four counties of Alabama—namely, Russell, Macon, Crenshaw, and Henry. The same varieties are included in these tests as in previous years and new ones are also included. Out of the seventeen varieties tested the five that have been leading for several years in yield of seed cotton and wilt

resistance are Cook No. 307-6 wilt resistant, Tri-Cook wilt resistant, Toole wilt resistant, Lewis No. 63 wilt resistant, and Hybrid No. 189 wilt resistant.

A number of isolation or multiplication experiments with wilt resistant varieties of cotton were placed with farmers with a view to rapidly multiplying the seed of varieties suited to the different localities.

Two experiments on methods of thinning cotton on wilt infected land were conducted in two localities. It appears that by planting cotton rather thickly on wilt infected soil and not thinning until a later date than is customary, the weaker plants die before rather than after thinning, thus obtaining ultimately a better stand of cotton than by the usual methods.

Respectfully submitted,

H. B. Tisdale,

Associate Plant Breeder.

REPORT OF ENTOMOLOGIST

Prof. J. F. Duggar,
Alabama Experiment Station,
Auburn, Alabama.

Dear Sir:

We are submitting a joint report on Local Experiment work for the calendar year 1920.

The principal work has been along the lines of cotton dusting for boll weevil control, the control of the grass worm and control studies with Mexican Bean Beetle. Special attention is, therefore, devoted to those subjects.

A list of the principal insect pests reported by correspondence during the year, with a brief statement regarding injuries and localities has been prepared for publication.

Cotton Dusting on 1920: Following similar lines to those started in 1919, cotton dusting experiments were located at Geneva, Geneva County, Notasulga, Macon County, and near Ft. Mitchell, Russell County. Messrs. R. H. Turner, O. W. Bridges and W. P. Whitlock were engaged temporarily to conduct the experiments in these locations. The work at Geneva and Notasulga was designed primarily to give further information upon the dusting at four or five day intervals of application and the profitableness of treatment under yield prospects ranging from less than one-half bale per acre to better than one bale per acre. At Ft. Mitchell the operation of twelve cart-dusting machines, representing three different makes, gave an unusual opportunity for a comparative study of these machines in operation under large plantation conditions.

Unfortunately a considerable portion of the detailed records in this work was destroyed in the burning of the agricultural building on October 16, 1920. However, the principal results of 1920 work have been included as Part II of Local Experiment Bulletin No. 212 which is now in the press.

Grass Worm: The grass worm or fall army worm (*Laphygma frugiperda*) was first noticed at Tuscaloosa and reported from Bibb County in early June. This was the first generation and did little damage although concern was felt regarding succeeding generations. The first part of July the second generation appeared

in far greater force than was expected and did a tremendous amount of damage especially to young corn. A large amount of arsenate of lead and calcium arsenate was used in dusting and spraying at this time as a result of the publicity given. Thirty counties were infested by this generation of worms. Practically the entire injury from the first and second broods occurred on land that had been overflowed and under water for some time during the flooded conditions of December 1919 and early spring of 1920. The third generation appeared when expected and the remainder of the counties in the State became infested. This brood on the whole was not as injurious as the second, corn was larger and the worms attacked grasses for the most part. The western sections of Alabama suffered most from this generation as the pasture lands in the Black Belt were temporarily injured. The natural parasitic enemies rapidly increased so that the fourth generation was unimportant, although it appeared.

Mexican Bean Beetle: Our first information as to the occurrence of this insect in Alabama was the receipt of specimens sent in from the vicinity of Blocton and Birmingham about the first of July 1920. Report of the occurrence was made immediately to the U. S. Bureau of Entomology and as soon as possible an investigation was started to determine the extent of the infestation. The best evidence that could be gathered indicated that the species was brought into the Birmingham district probably through car-load shipments of alfalfa hay coming from Colorado, Arizona or New Mexico in 1918. Only two parties have been found who had noticed the new pest on beans during the season of 1918. In several cases, however, the insect was noticed in Bibb and Jefferson counties during the summer of 1919, but was not reported to this Department, as the seriousness of the matter seems not to have been appreciated.

This dangerous pest has been known to be exceptionally free from natural enemies and very difficult to control by insecticidal measures in its western habitat. There it is reported as occurring at altitudes up to 7,000 feet and surviving winter minimum temperatures of 30 to 35 degrees below zero. The occurrence of this species in this section threatens the continued profitable production of all kinds of table beans, cow peas and

soy beans. The study of control measures was undertaken in August, 1920, and will henceforth become our principal line of Local Experiment work.

The principal information available about this insect at this time is contained in a phamplet now being published under the Local Experiment fund.

Miscellaneous Insect Pests: A review of the Department records for 1920 shows that an unusual variety of economic pests has been reported. Several of these species are of serious importance and wide-spread distribution. Little is known regarding their control and special study should be given to them as soon as may be possible.

Respectfully submitted,
W. E. Hinds,
Entomologist.
F. L. Thomas,
Associate Entomologist.

REPORT OF ANIMAL HUSBANDMAN

Professor P. F. Duggar,

Alabama Experiment Station,

Auburn, Alabama.

Dear Sir:

I respectfully submit the following report of Local Experiment work conducted by the Animal Husbandry Department during the past fiscal year:

Beef Cattle

The cooperative steer feeding work at Allenville, Marengo County, Alabama, was continued throughout the year. Judge B. M. Allen furnished the cattle and feed for the experiment and the Alabama Experiment Station furnished a trained man, Mr. Ernest Gibbens, to live on the farm and have personal supervision of the work. The tests conducted were to determine the following points:

1. To compare the relative value of an inferior quality of Johnson grass hay and sorghum silage as a roughage for wintering cows when fed in connection with cottonseed meal at the rate of one pound meal per head daily.
2. To compare the comparative feeding value of cottonseed meal and velvet beans for fattening steers when fed in three different forms—dry, soaked, and ground.

In the first test twenty head of mature Hereford cows were used, and were fed as follows:

Lot 1. Ten head; 1 pound cottonseed meal and Johnson grass hay.
Lot 2. Ten head; 1 pound cottonseed meal and sorghum silage.

In the second test thirty-two head of steers were fed as follows:

Lot 1. Eight head; cottonseed meal and sorghum silage.
Lot 2. Eight head; dry velvet beans and sorghum silage.
Lot 3. Eight head; soaked velvet beans and sorghum silage.
Lot 4. Eight head; ground velvet beans and sorghum silage.

It is planned to repeat this work during this year in order to secure additional data on the subject.

Hogs

The cooperative experimental work with hogs is being conducted on the farm of Mr. Parke Thompson, Goshen, Alabama. Mr. Thompson furnishes the hogs, feed, and equipment, and the Alabama Experiment

Station furnishes a man to live on the farm and do the feeding.

The object of the test being conducted is:

1. To determine the pounds of live pork per 100 pounds picked runner peanuts alone, and with various supplements.
2. To compare on a basis of gains and melting point of fat, corn with tankage, and a mixture of corn plus tankage, all used as feeds supplementary to peanuts.

Four lots of six pigs each were fed as follows:

Lot 1. Picked runner peanuts, in self feeder.
Lot 2. Picked runner peanuts and shelled corn, in self feeder.
Lot 3. Picked runner peanuts and 60% tankage, in self feeder.
Lot 4. Picked runner peanuts, shelled corn, and tankage in self feeder.

Poultry

The cooperative experimental work with Mr. Herman Schlueterbusch, Citronelle, Mobile County, Alabama, was continued throughout the year. The tests conducted were as follows:

1. A study of several feeds to determine their relative efficiency and economy in egg production.
2. A study of several feeds—beef scrap, skim milk, peanut meal, and velvet bean meal as a source of part of the protein in the ration to determine the relative efficiency of each feed as influencing the egg yield and cost of egg production.
3. A study to determine the best age at which to market poultry.
4. A study of the influence of selection on egg production.

In addition to the above work a test was started during the past fall to compare the relative value of vegetable and animal protein as influencing egg production.

Respectfully submitted,

J. C. Grimes,

Head Animal Husbandry Department.

REPORT OF HORTICULTURIST

Prof. J. F. Duggar,

Alabama Experiment Station,

Auburn, Alabama.

Dear Sir:

The work carried on under Local Experiment funds, beginning with 1912 and continuing until the end of 1919, has been summarized and is ready for publication.

Owing to the small amount of available funds, only one-half of one man's time has been available for Local Experiment work throughout the State. This has very greatly limited the work that could be done and much of the work started in earlier years had to be abandoned because of the inability of one man to be on hand to take the notes , and of the unreliability of vegetable notes made by the average farmer. Probably no class of plants is as difficult to secure data upon as vegetable plants, which must be harvested at exactly the right moment or data secured would be absolutely worthless. Most of these vegetable and perishable fruit experiments have been discontinued but a considerable number of the variety studies, formerly started with tree fruits, are being continued in various sections of the State. Some of these are proving notably successful.

A number of fertilizer experiments on Satsuma had to be abandoned because it was discovered that we were dealing with three varieties of Satsuma instead of one.

One new project has been started, however, and is proving very successful—that of the study of the effect of pruning, tillage and nitrate of soda on a frost damaged Satsuma orchard located on the farm of Robert L. Brown at Irvington, Alabama.

The small plantings located at many points in the State of fruits for observation have been abandoned for a fewer number of projects covering a larger acreage. The first planting of this character was made in the Spring of 1920 on the farm of the Talladega Presbyterian Orphanage at Talladega, Alabama, and covers eighteen acres, which will be enlarged, with ten or more of the leading commercial varieties of apples un-

der observation. Tillage, spraying and fertilizing problems will be studied at this place.

Other projects will be started as soon as arrangements can be completed.

Respectfully submitted,

G. C. STARCHER,

Horticulturist.

REPORT OF DRAINAGE ENGINEER

Prof. J. F. Duggar, Director,
Alabama Experiment Station,
Auburn, Alabama.

Dear Sir:

Under the cooperative agreement between the Alabama Experiment Station and the office of Drainage Investigations, Bureau of Public Roads, U. S. Department of Agriculture, the following drainage and terracing work was accomplished during the year 1920.

Swamp and Overflow

During the year very little progress was made on the several large Drainage Districts started in previous years. The high cost of materials and labor caused the several districts to defer work until more favorable conditions. Two proposed districts were inspected and preliminary reports prepared outlining the procedure to be followed in organizing drainage districts and giving an estimate of cost of the proposed work. These districts were the Oakmulgee Creek district in Dallas, Perry and Chilton Counties with an area of from 10,000 to 12,000 acres of creek bottom land along Big and Little Oakmulgee Creeks, and the walnut Creek swamp of from 600 to 700 acres surrounding the town of Clanton, in Chilton County.

A revision of the drainage plans and cost estimate for the Fowl River and Mobile Bay View Growers Association Drainage District was also made. This District is located a short distance south of Mobile and contains 3,500 acres. It is understood that the petition for the formation of this district is now ready to be presented to the Probate Court of Mobile County.

The Fayette and Lamar Counties Drainage District has raised money to continue the canal location survey and the work will be completed this Spring. Over 22,000 acres are involved in the plans of reclamation on this district.

Farm Drainage and Terracing

Assistance in farm drainage, involving surveys, maps and reports, recommendations and inspections for drainage, or in laying off terrace systems or making recommendations for their installation have been given in the following counties:

Baldwin, Bullock, Dale, Dallas, Elmore, Hale, Lime-

stone, Lowndes, Macon, Marengo, Mobile, Montgomery, Perry and Pickens, and in active cooperation with the following County Agents: Mr. John Blake of Selma, Mr. E. R. Jameson of Greensboro and Mr. G. V. Stelzenmuller of Bay Minette.

The following is a list of the individual tracts visited:

Mr. A. C. Barnes, Summerdale, Baldwin County, terraces built.

Mr. N. J. Bell, Calhoun, Lowndes County, drainage survey and installation.

Mr. J. W. Brown, Scott Station, Perry County, survey and installation.

Calhoun Colored School, Calhoun, Lowndes County, survey and installation.

Dr. Chas. F. Chandler, Montgomery City, garden survey and installation.

Miss Rachael Grook, Three Notch, Bullock County, inspection and terraces.

Judge M. S. Carmichael, Midland City, Dale County, survey.

Dr. J. G. Criel, Montgomery, inspection of ineffective system.

Mr. A. B. Hall, Denton, Lowndes County, survey and installation.

Mr. C. T. Hall, Grand Bay, Mobile County, survey.

Mr. Axil Johnson, Fair Hope, Baldwin County, survey.

Mr. J. L. Jones, Montgomery County, survey.

Mr. A. Jung, Fair Hope, Baldwin County, terracing.

Mr. E. R. Jamison, Greensbo.o, Hale County, survey.

Mr. Joe Lambert, Orrville, Dallas County, survey.

Mr. L. J. Lawson, Greensboro, Hale County, survey.

Mr. E. W. Norris, Montgomery County, survey and installation.

Mr. A. D. Rich, Montgomery County, survey.

Mr. Cole Savage, Gordo, Pickens County, survey and installation.

Mr. W. H. Smith,Prattville, Autauga County, survey and installation.

Mr. J. C. Tidmore, Moundville, Hale County, survey.

Mr. Jas. H. Tolley, Belle Mina, Limestone County, survey.

Dr. L. B. Wilkerson, Shorters, Macon County, survey.

Mr. Jno. R. Witt, Belle Mina, Limestone County, installation.

Mr. C. A. Woods, Grand Bay, Mobile County, survey.

Data were obtained upon the effect of tile drainage in various sections of the State, the crop yield measured on several tile drained tracts and comparisons made with adjacent lands that were not tile drained. Increased crop yields from two to five times the former average yields were noted.

Three trenching machines have been located in the Black Belt Section during the year and have been used in installing tile drains on some six or seven hundred acres of land.

Very truly yours,
P. St. J. Wilson,
Chief Engineer.

REPORT OF AGRICULTURAL ENGINEER

Auburn, Ala., Dec. 28, 1920.

Prof. J. F. DUGGAR, Director,
Auburn, Alabama.

Dear Sir:

In compliance with your request of November 30, concerning a report for the Agricultural Engineering Department for the year ending December 31, 1920, I beg to submit the following:

Unfortunately the records which we had obtained have been lost in the fire that destroyed the agricultural building, and it is almost impossble from memory to make a satisfactory report.

Organization: The time allotted to the Experiment Station work by this Department is five twenty-sevenths of one man's time. The subjects in which we have done some work are: (1.) Land Clearing; (2.) The use of the products of land clearing from destructive distillation; (3.) Preservative and Water-proofing treatments for farm buildings; (4.) Suitable equipment for chilling and cooling pork to assist in butchering in hot weather; (5.) The modification of equipment to suit our agricultural conditions; and (6.) Terracing.

Land Clearing: In land clearing a considerable area was cleared in the vicinity of Mobile, amounting to about seven acres in fat pine stumps. Various methods were tried with the use of explosives. We tried out very carefully Hercomite, a 60 percent explosive; 20 percent Red Cross dynamite; 40 percent Red Cross dynamite; and DuBell dynamite.

In this experiment we wished to find out the most effective explosive, and our results tended to show us that the higher percent explosives were the most economical, since we obtained more power for less money.

Records were also made on the cost of burning stumps. These data were collected from work on three acres which were not included in the above seven acres. In the three acres burned the cost was $15.00 per acre with no returns. However, in the area blasted, the value of the wood, exclusive of the hauling, more than equaled the labor and explosives used; the cost averaged about $20.00 per acre, and the wood averaged seven tons, selling at about $4.90 per ton.

A new method for blasting stumps was tried out. The old practice has been to place the charge of explosive at an angle of approximately 45 degrees. This left the cut-off parts of the tap root of the stump near the ground, and did not cut off a large amount of the tap root. After a considerable amount of experimentation, we secured a new boring machine, and bored rather deeply, placing the charge deep in the heart of the tap root, at least two feet down. Under these conditions dynamite was able to cut the tap root off 18 inches deep and to split up the stump. As a result of this work, a number of commercial distillers have adopted this method of blasting. One of the companies states that it has saved $5.00 per acre by this method.

Destructive Distillation: The work (using pine stumps and other waste material available in the clearing of cutover land) with destructive distillation has been rather limited. However, a considerable amount of investigation has been done and relations established with large distillers of wood. These men have very crude and incomplete apparatus, but the data obtained show that we can considerably increase the output by improved methods.

Two or three new plants have been constructed, and are now in operation, but none of them have as yet arrived at the correct scientific basis necessary to the most economical handling of this material.

Wood and Roof Preserving: In the water proofing treatment and preservation of woods a considerable amount of data was gathered looking to the methods of renovating old shingle roofs.

Chilling Pork: Some work has been done on cooling pork, so that it may be properly preserved.

Fertilizing Equipment: Some work was done in preparing a machine which would properly distribute fertilizer for citrus trees. The hand method that is now used is very expensive. Modifications will be made of apparatus now on the market for the purpose.

Terracing: In connection with other work with terraces, records are being made to determine the effect of grade and its relation to soil types.

Respectfully submitted,

M. L. Nichols,

Agricultural Engineer.